TROUBLE SHOOTING

(N-550 PULSE OXIMETER)

1. Problem Categories.

This document is made for service training personnel, and based on Service manual. Problems with the N-550 are separated into the categories in Table 1. Refer to the paragraph indicated for further troubleshooting instructions in this section.

Note: Taking the recommended actions discussed in this section will correct the majority of problems you will encounter.

Note: If the action requires replacement of a PCB assembly, module, and part, refer to Assembly/Disassembly Instruction.(Doc: MDA-I-070-09S)

Table 1. PROBLEM CATEGORIES.

Problem Area	Refer to Paragraph
1. Power ✍ No power-up ✍ Fails power-on self-test ✍ Powers down without apparent cause	**2. Power (Page:2-3)**
2. Buttons ✍ Monitor does not respond properly to buttons being pressed	**3. Buttons (Page 3)**
3. Display/Alarms ✍ Display does not respond properly ✍ Alarms and other tones do not sound properly or are generated without apparent cause	**4. Display/Alarms (page 3)**
4. Operational Performance ✍ Displays appear to be operational, but monitor shows no readings ✍ Suspect readings	**5. Operational Performance (Page 4)**
5. Data Port ✍ N-550 data port not functioning properly	**6. Data Port (Page 4)**
6. Error codes	**7. Error codes (Page 4-6)**

2. Power

Power ON/OFF failures are related to AC or DC. Table 1 lists recommended actions to address power problems.

Table 2. Power ON/OFF failures

Symptom	Recommended Action
1. Battery Low indicator lights steadily while N-550 is connected to AC and battery is fully charged.	1. Ensure that the N-550 is plugged into an operational AC outlet and the AC indicator is on. 2. Check the fuses. The fuses are located in the Power Supply PCB, and replace if necessary 3. Verify the LEDs ON/OFF status on the main PCB. (CD4 blinking: check the initial battery status, CD 4 ON: under charging, CD5: extremely low battery or charger circuit failure, CD3 ON: Full charged status). If CD5 is ON, replace the Main PCB. 4. Verify the power supply's output to the battery while on AC. Disconnect the battery leads from the battery and connect a DVM to them. The voltage measured should be 19 VDC to 21 VDC and the charging current should be 50 mA to 250 mA. Replace power supply if above values are not met. 5. Check the cable connection between the Top Enclosure and the Front Panel PCB. If the connection is good, replace the Front Panel PCB
2. The N-550 does not operate when disconnected from AC power	1. The battery may be discharged. Recharge the battery. 2. Ensure the battery fuse is OK, and battery wire connection is correct.. 3. If the problem persists, replace the battery 4. If the problem still persists, replace Main PCB.
3. Battery Low indicator on during DC operation and an alarm is sounding.	1. There are 15 minutes or less of usable charge left on the N-550 battery before the instrument shuts off. At this point, if possible, cease using the N-550 on battery power, connect it to an AC source and allow it to recharge (approximately 11 hours). The N-550 may continue to be used while it is recharging. (A full recharge of the battery while the monitor is being used takes 12 hours.).
4. Battery does not charge	1. Replace battery if it is more than 2 years old. 2. Verify the power supply's output to the battery while on AC. Disconnect the battery leads from the power supply and connect a DVM to them. The voltage measured should be 19 VDC to 21 VDC and the current should be 50 mA to 250 mA. Replace the power supply if the above values are not met. 3. If the problem persists, replace the Main PCB.

3. Buttons

The Table 3. lists the problems related to display failure symptoms and troubleshooting.

Table 3. Button problems

Symptom	Recommended Action
1. The N-550 turns on and responds to some, but not all, buttons.	1. Replace Front Panel PCB. 2. Replace Top Housing assembly.
2. The N-550 turns on but does not respond to any of the buttons	1. Check the connection between the Main PCB and the Front Panel PCB. 2. Replace the Front Panel PCB. 3. Replace Top Housing assembly.

4. Display/Alarms

The Table 4. lists the problems related to Display and Alarm failure symptoms and troubleshooting.

Table 4. Display/Alarm Problems

Symptom	Recommended Action
1. Display values are missing or erratic	1. Try another sensor or relocate the sensor 2. Replace the Sensor Extension Cable 3. Replace the SpO2 Module. 4. Replace the Front Panel PCB.
2. Not all display segments light during POST	1. Check the connection between the Front Panel PCB and the Main PCB. 2. Replace the Front Panel PCB.
3. Alarm sounds for no apparent reason	1. Moisture or spilled liquid can cause an alarm to sound. Allow the monitor to dry thoroughly before use. 2. If the problem persists, replace the Main PCB
4. Display is flashing but there is no alarm	1. Verify that alarm silence has not been activated 2. Check speaker connection to Front Panel PCB. 3. Replace the speaker. 4. If the problem persists, replace the Main PCB
5. An alarm condition exists but no alarm (audible or visual) is indicated	1. Replace the Front Panel PCB 2. Ensure the speaker wire connection is good. If the problem persists replace the speaker. 3. Replace the Main PCB.

5. Operational Performance

The Table 5. lists the problems related to Operational Performance failure symptoms and troubleshooting.

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Table 5. Operational Performance Problems

Symptom	Recommended Action
1. The pulse amplitude indicator seems to indicate a pulse, but the digital displays show zeroes	1. The sensor may be damaged; replace it 2. Replace the SpO2 Module 3. If the problem persists, replace the Front Panel PCB.
2. SpO2 or pulse values change rapidly; Pulse Amplitude indicator is erratic	1. The sensor may be damp or may have been reused too many times. Replace it. 2. An electrosurgical unit (ESU) may be interfering with performance: - Move the N-550 and its cables and sensors as far from the ESU as possible. - Plug the N-550 power supply and the ESU into different AC circuits. - Move the ESU ground pad as close to the surgical site as possible and as far away from the sensor as possible. 3. If the problem persists, replace the SpO2 Module. 4. If the problem still persists, replace the Front Panel PCB.

6. Data port

Table 6. lists symptoms of problems related to Data port and recommended actions.

Table 6. Data port Problems

.Symptom	Recommended Action
1. No printout is being received.	1. The monitor is running on low battery power. Connect the monitor to AC power 2. The monitor's baud rate does not match the printer. Change the baud rate of the monitor following instructions in the Operator's manual. 3. Check the connection between the data port and the printer. 4. Replace the Main PCB. 5. Replace the Front Panel PCB.

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7. Error Codes

When the N-550 detects an error condition, the monitor will attempt to show an error code on the segment display.

If such an error occurs during the operation, the monitor will sound a low-priority alarm.

Table 7 provides a complete list of error codes and problem identification.

If an error code occurs, take the following actions:

1. Turn monitor off, and reset by pressing the alarm button and ON/OFF button for longer than 2 seconds. Then on again.

Note: If error code still appears, follow the recommended actions on Table 5. Operational Performance problem.

Table 7. Technical Error Codes

Error Codes	Explanation
1	SpO2 front end RAM error
2	SpO2 front end ROM/code integrity error.
3	SpO2 front end reported bad CRC
4	SpO2 front end reported FSP message not allowed
5	SpO2 front end reported illegal value sent in FSP message.
6	SpO2 front end reports calibration (offset) failure
9	SpO2 front end reported syntax error in FSP message
10	Over-current limit in SpO2 front end has tripped
11	SpO2 front end reports incorrect system voltage
12	SpO2 front end reports other hardware problem
14	SpO2 front end reports communication channel overflow
16	SpO2 front end reports watch dog time out
17	SpO2 front end reports that sensor appears defective
18	SpO2 front end reports internal register appears modified fromexpected value
19	SpO2 front end reports signal out-of-range
48	SpO2 front end reports spurious interrupt
49	SpO2 front end reports internal buffer overflow
50	SpO2 front end reports intermittent error
51	SpO2 front end reports digital communications error
52	SpO2 front end reports warmer error
53	SpO2 front end data not received
256	SpO2 back end reports beginning of packet missing
257	SpO2 back end reports end packet start ID (SID) missing
258	SpO2 back end reports packet length error
259	SpO2 back end reports message length error
260	SpO2 back end reports packet contains unsupported key
261	SpO2 back end reports packet CRC error
262	SpO2 back end reports end of packet missing
263	SpO2 back end reports packet contains undefined key
264	SpO2 back end reports corrupted variable
265	SpO2 back end reports memory overflow
266	SpO2 back end reports bad pointer
267	SpO2 back end reports parameter value out-of-range
268	SpO2 back end reports reset detected
269	SpO2 back end reports unexpected value
270	SpO2 back end reports timeout
271	SpO2 back end reports not ready/not initialized
272	SpO2 back end reports double fault

273	SpO2 back end reports date out-of-range error
274	SpO2 back end reports incompatible software version
275	SpO2 back end reports incorrect registration number
276	SpO2 back end reports sensor read failure
277	SpO2 back end reports sensor signature verification fails
278	SpO2 back end reports warmer sensor temperature set point failure
279	SpO2 back end reports warmer sensor/SpO2 front end incompatible
280	SpO2 back end SpO2 back end reports does not support feature required by sensor
281	SpO2 back end reports overflow/underflow
282	SpO2 back end reports sSpO2 back end reports sensor activation failure
283	SpO2 back end reports sensor write failure
512	General failure of UIF module generic post
513	Dead battery/Missing battery
514	Real time clock non-operational
515	Application code is not present in the flash
516	Invalid flash type
517	Serial clock line is not toggled or is toggling at an incorrect rate
518	Application program is corrupt
519	Invalid SpO2 front end version
520	Error in start up sequence
521	OS multitasking service failure
522	A state machine has received an unknown state transition
523	The operation just attempted was not completed successfully – for example, Institutional Defaults could not be reset
524	An unexpected value was received - for example, a out-of range parameter was passed to a function
525	EEPROM CRC failure
526	SpO2 module not responding
527	Institutional parameters lost - eg for UIF: Institutional EEPROM section CRC corrupted
528	Current settings lost - eg for UIF: current EEPROM section CRC corrupt